FIG. 1A

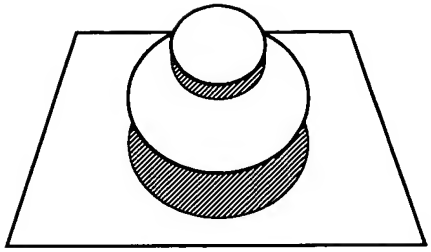


FIG. 1B

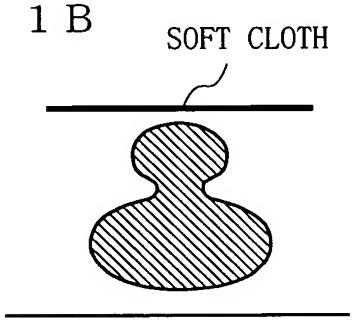


FIG. 1C

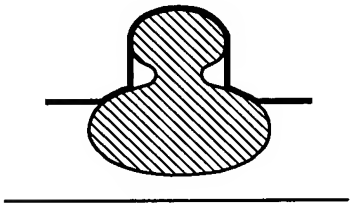


FIG. 1D

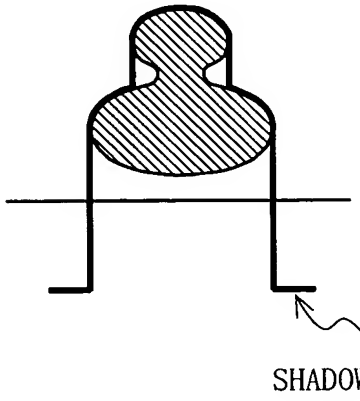


FIG. 1E

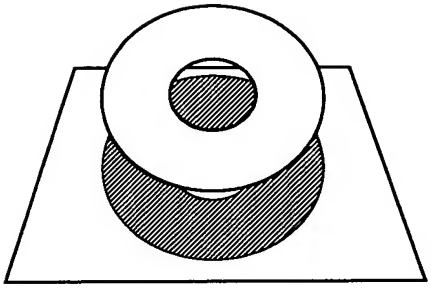


FIG. 1F

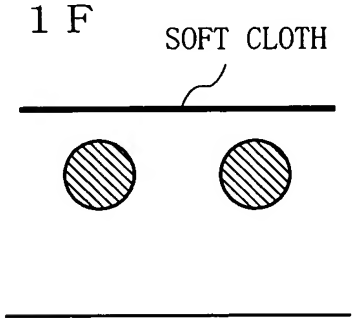


FIG. 1G

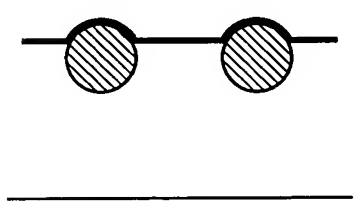


FIG. 1H

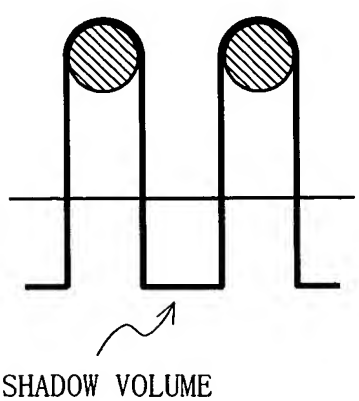


FIG. 2A

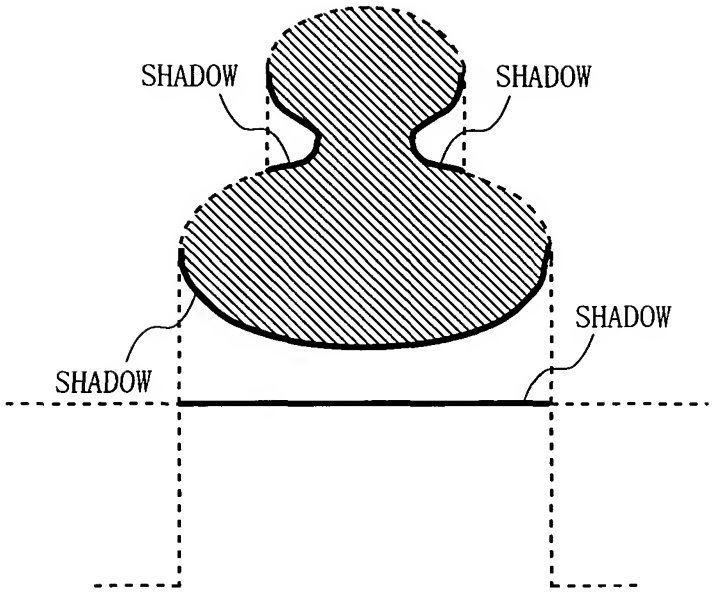


FIG. 2B

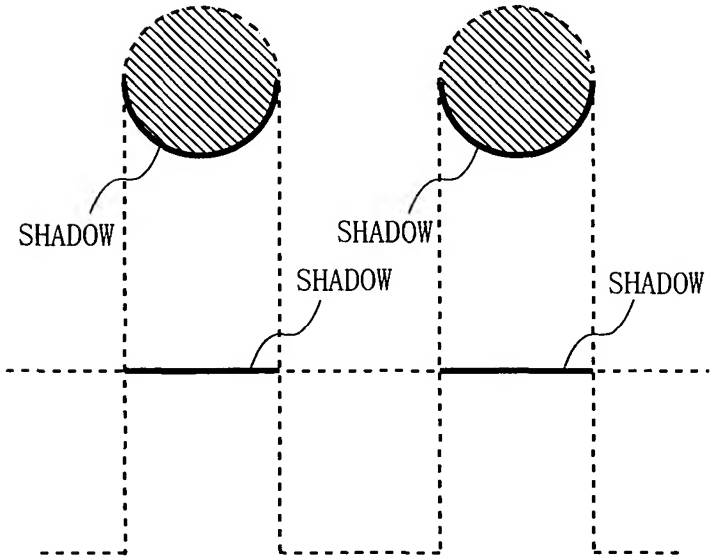


FIG. 3

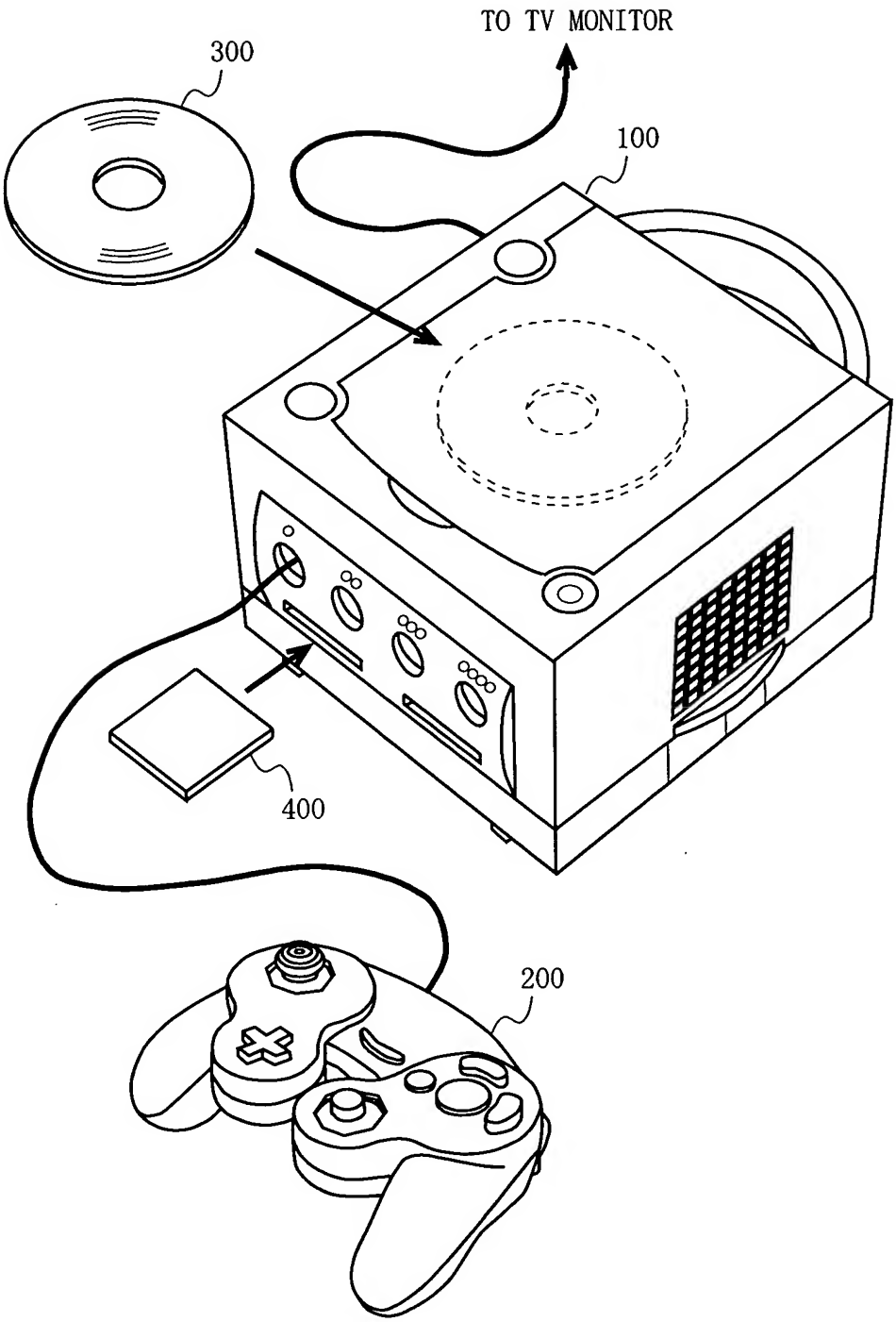


FIG. 4

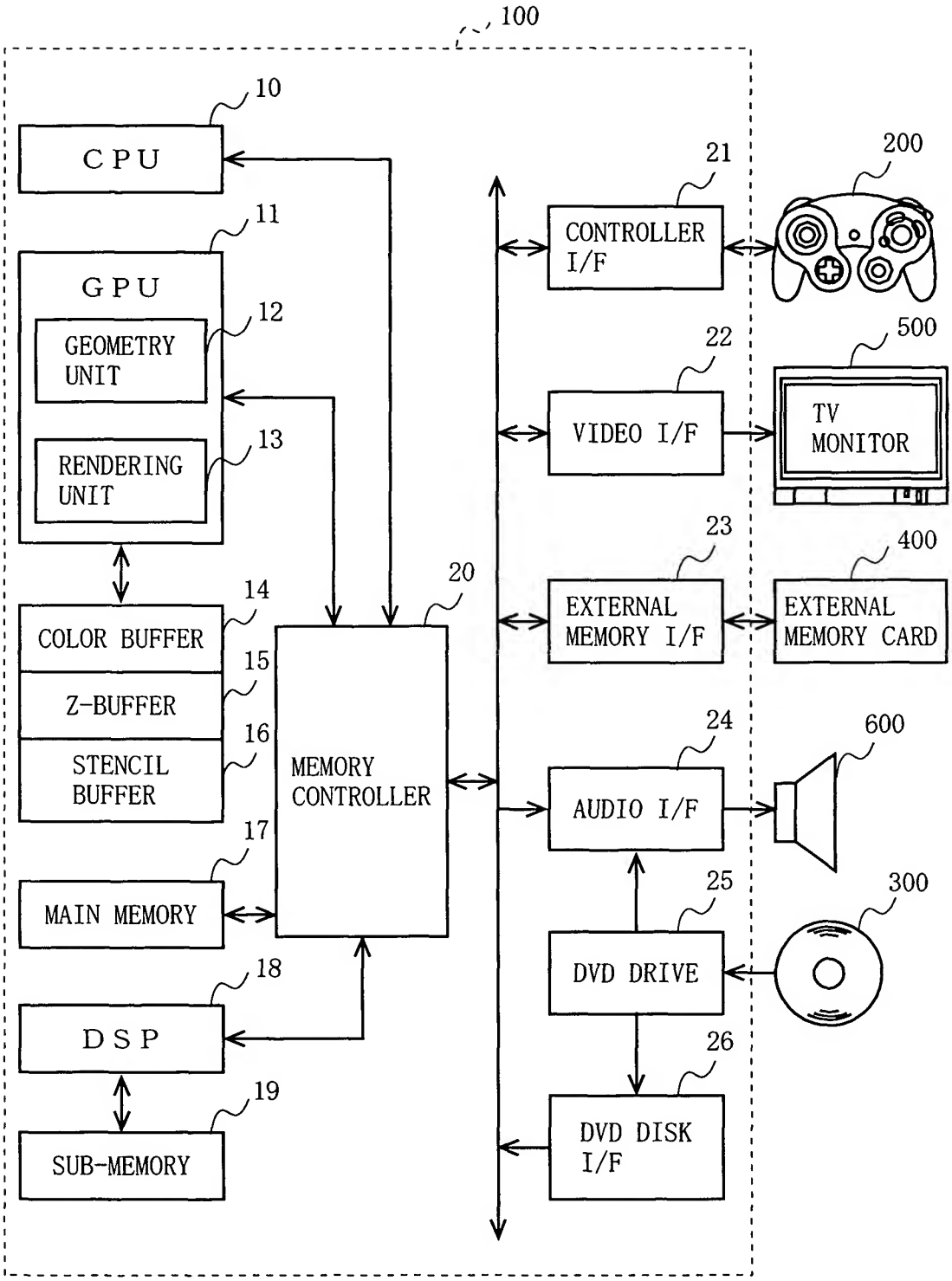

100
10
CPU
11
GPU
12
GEOMETRY UNIT
13
RENDERING UNIT
14
COLOR BUFFER
15
Z-BUFFER
16
STENCIL BUFFER
17
MAIN MEMORY
18
DSP
19
SUB-MEMORY
20
MEMORY CONTROLLER
21
CONTROLLER I/F
200
22
VIDEO I/F
500
TV MONITOR
23
EXTERNAL MEMORY I/F
400
EXTERNAL MEMORY CARD
24
AUDIO I/F
600
25
DVD DRIVE
300
26
DVD DISK I/F

FIG. 5

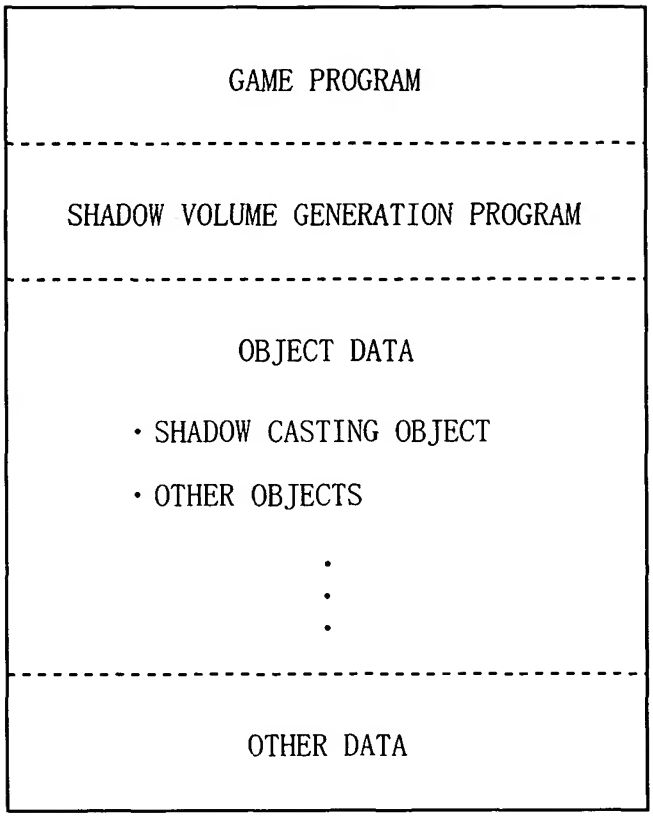

GAME PROGRAM
SHADOW VOLUME GENERATION PROGRAM
OBJECT DATA
• SHADOW CASTING OBJECT
• OTHER OBJECTS
OTHER DATA

FIG. 6

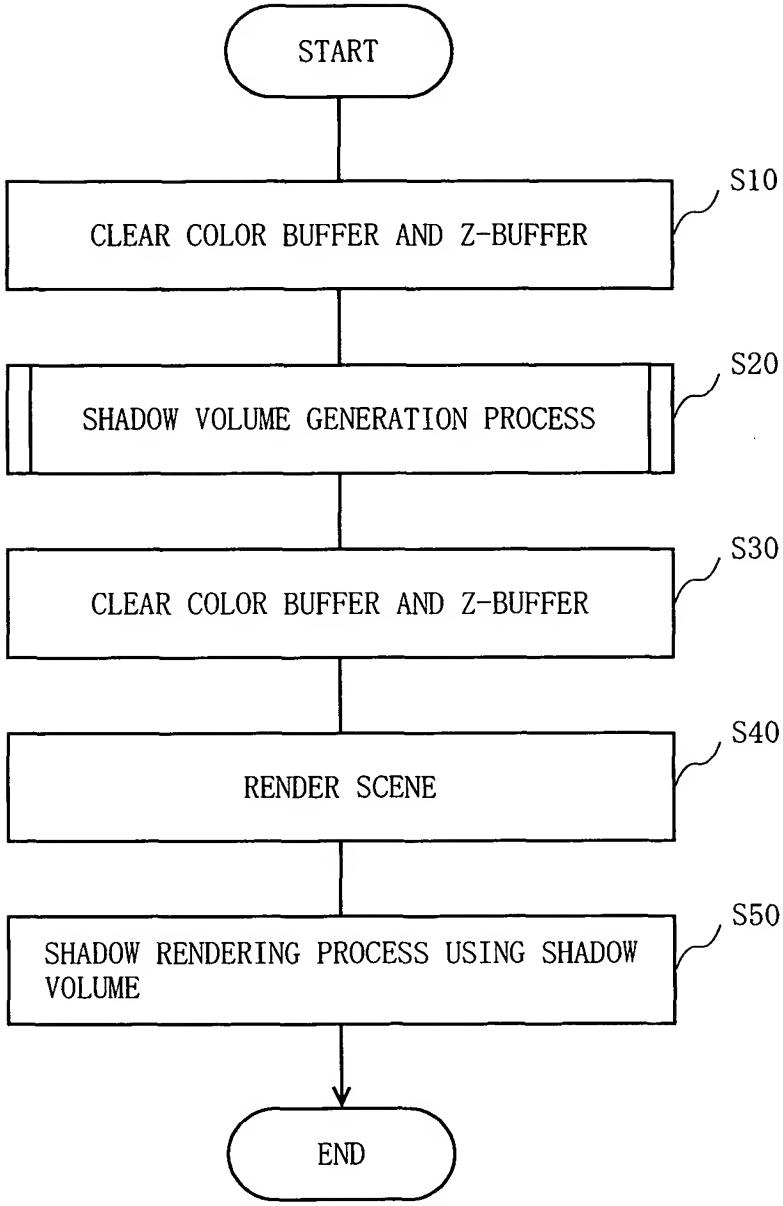

START
CLEAR COLOR BUFFER AND Z-BUFFER
S10
SHADOW VOLUME GENERATION PROCESS
S20
CLEAR COLOR BUFFER AND Z-BUFFER
S30
RENDER SCENE
S40
SHADOW RENDERING PROCESS USING SHADOW VOLUME
S50
END

FIG. 7

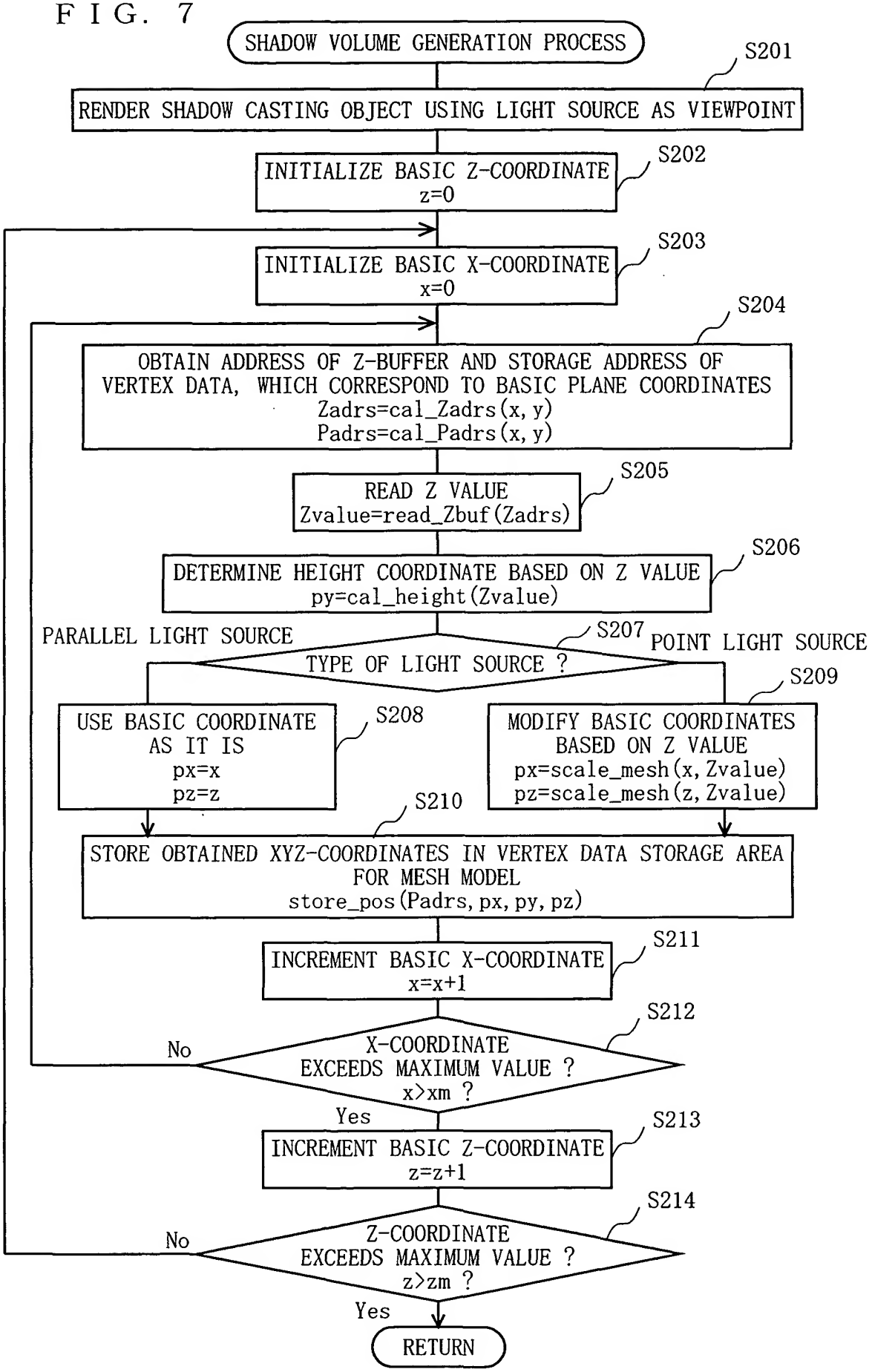

SHADOW VOLUME GENERATION PROCESS
S201
RENDER SHADOW CASTING OBJECT USING LIGHT SOURCE AS VIEWPOINT
INITIALIZE BASIC Z-COORDINATE
z=0
S202
INITIALIZE BASIC X-COORDINATE
x=0
S203
S204
OBTAIN ADDRESS OF Z-BUFFER AND STORAGE ADDRESS OF VERTEX DATA, WHICH CORRESPOND TO BASIC PLANE COORDINATES
Zadrs=cal_Zadrs(x, y)
Padrs=cal_Padrs(x, y)
READ Z VALUE
Zvalue=read_Zbuf(Zadrs)
S205
DETERMINE HEIGHT COORDINATE BASED ON Z VALUE
py=cal_height(Zvalue)
S206
PARALLEL LIGHT SOURCE
TYPE OF LIGHT SOURCE ?
S207
POINT LIGHT SOURCE
USE BASIC COORDINATE AS IT IS
px=x
pz=z
S208
MODIFY BASIC COORDINATES BASED ON Z VALUE
px=scale_mesh(x, Zvalue)
pz=scale_mesh(z, Zvalue)
S209
STORE OBTAINED XYZ-COORDINATES IN VERTEX DATA STORAGE AREA FOR MESH MODEL
store_pos(Padrs, px, py, pz)
S210
INCREMENT BASIC X-COORDINATE
x=x+1
S211
X-COORDINATE EXCEEDS MAXIMUM VALUE ?
x>xm ?
S212
No
Yes
INCREMENT BASIC Z-COORDINATE
z=z+1
S213
Z-COORDINATE EXCEEDS MAXIMUM VALUE ?
z>zm ?
S214
No
Yes
RETURN

FIG. 8A

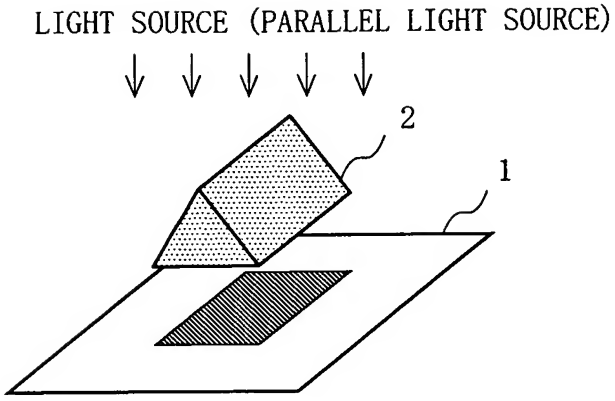


FIG. 8B

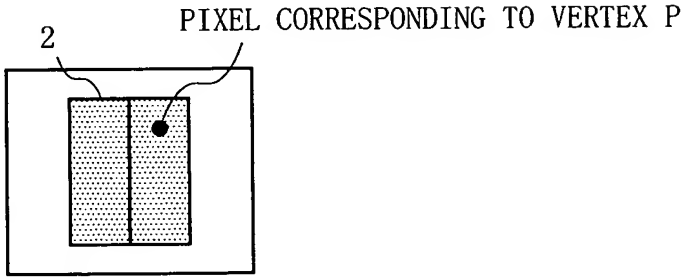


FIG. 8C

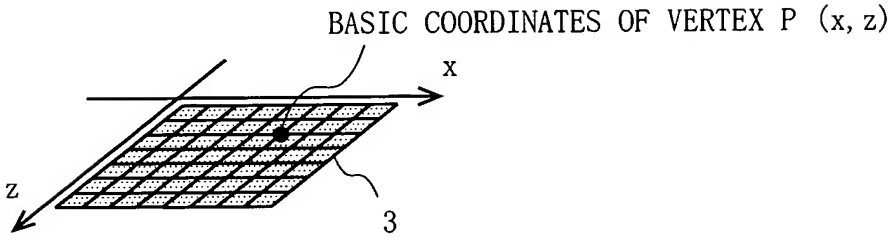


FIG. 8D

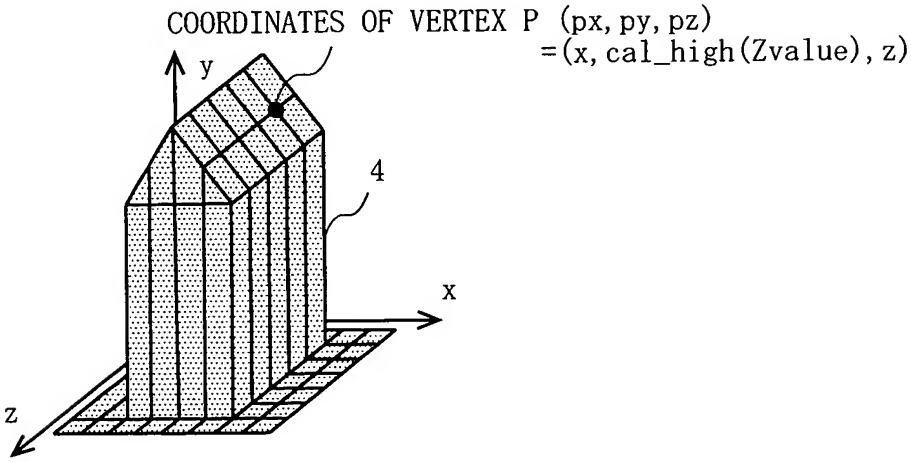


FIG. 9

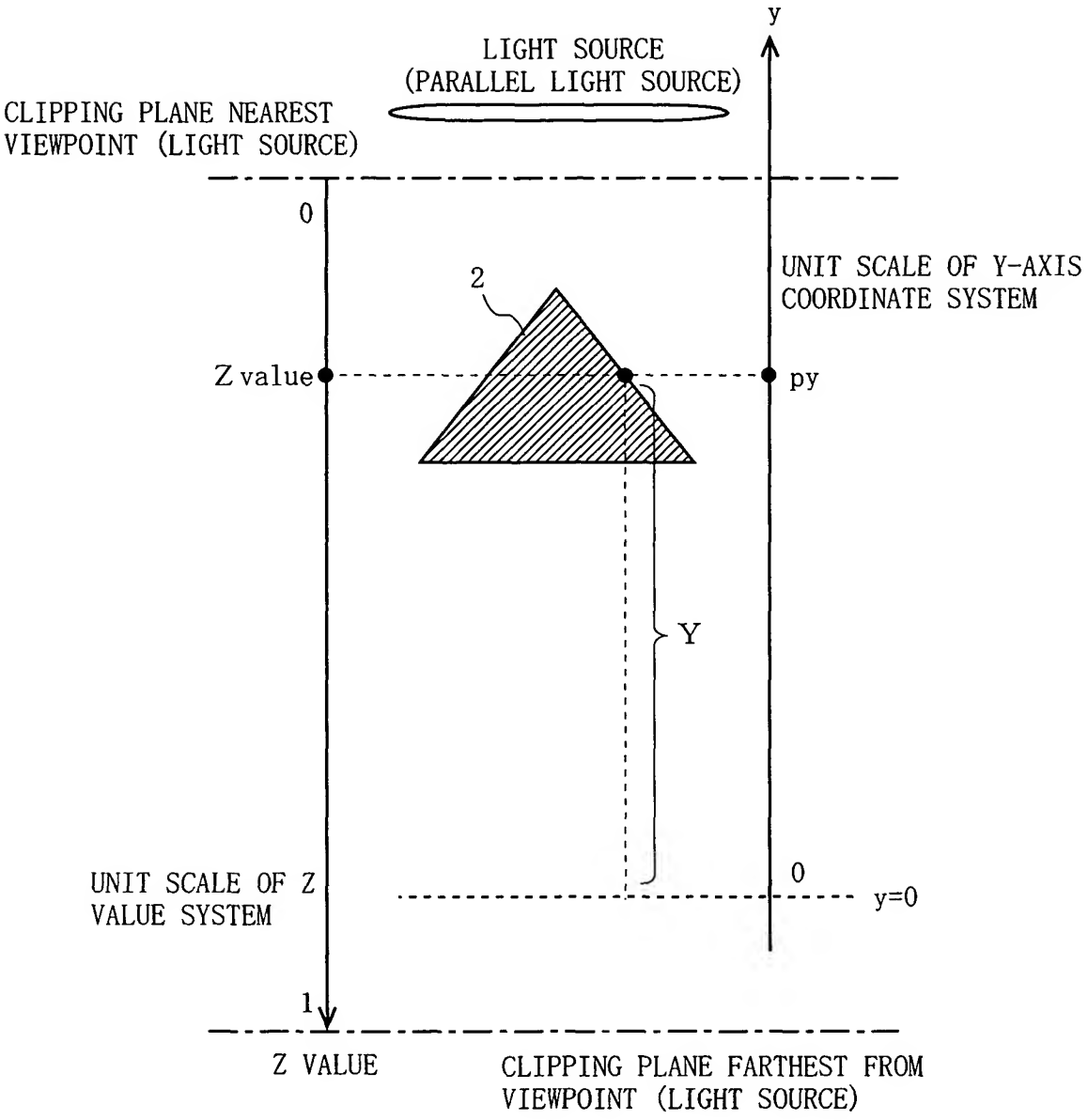

y
LIGHT SOURCE
(PARALLEL LIGHT SOURCE)
CLIPPING PLANE NEAREST
VIEWPOINT (LIGHT SOURCE)
0
2
UNIT SCALE OF Y-AXIS
COORDINATE SYSTEM
Z value
py
Y
UNIT SCALE OF Z
VALUE SYSTEM
0
y=0
1
Z VALUE
CLIPPING PLANE FARTHEST FROM
VIEWPOINT (LIGHT SOURCE)

FIG. 10A

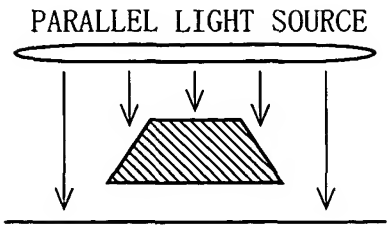


FIG. 10B

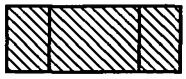


FIG. 10C

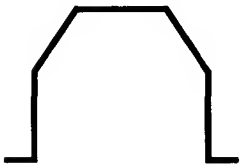


FIG. 10D

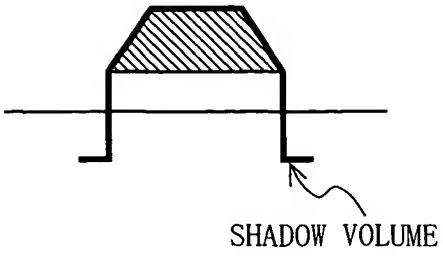


FIG. 10E

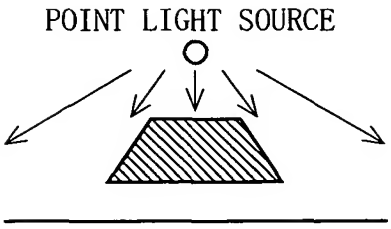


FIG. 10F

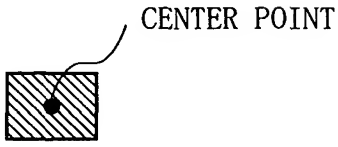


FIG. 10G

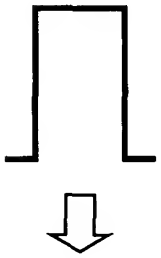


FIG. 10H

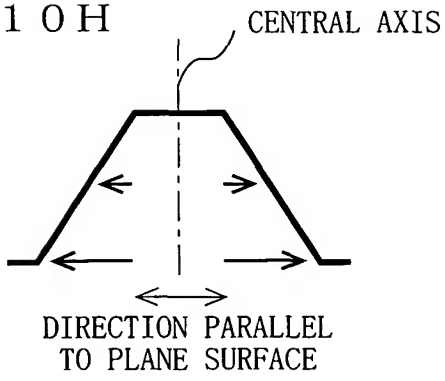


FIG. 10I

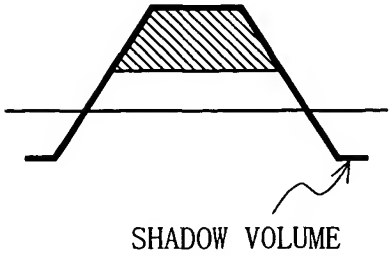


FIG. 11A

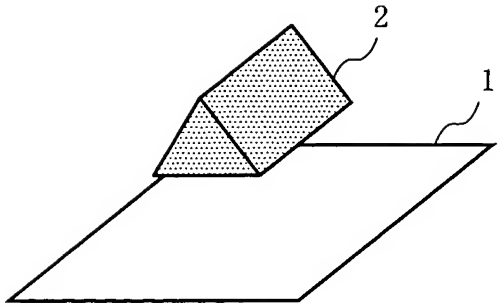
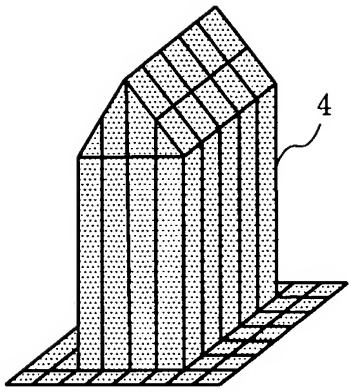


FIG. 11B



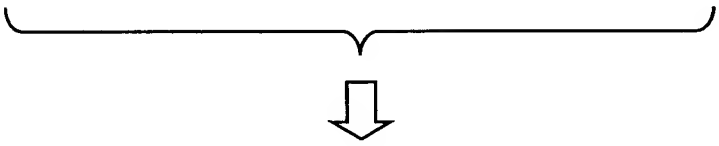


FIG. 11C

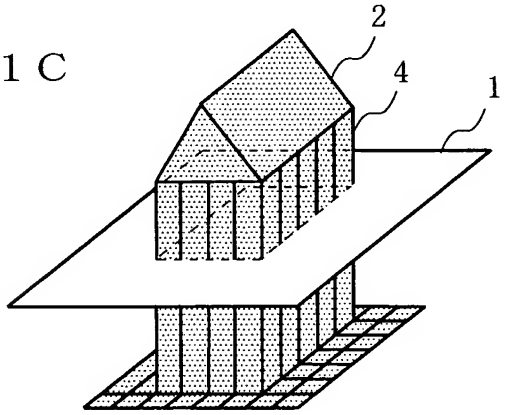


FIG. 11D

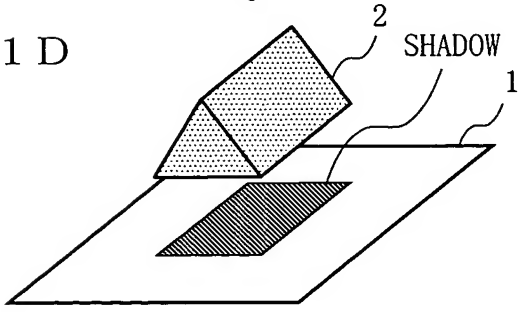


FIG. 12A

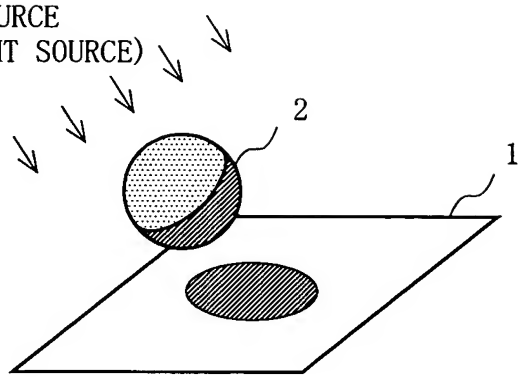


FIG. 12B

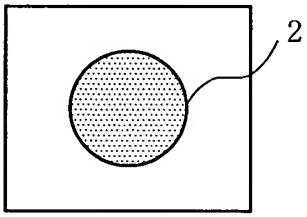


FIG. 12C

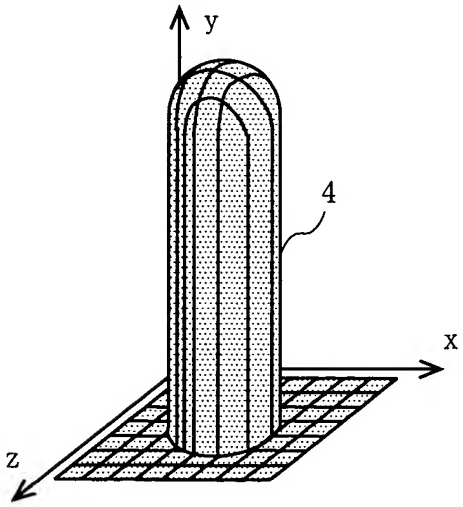


FIG. 13A

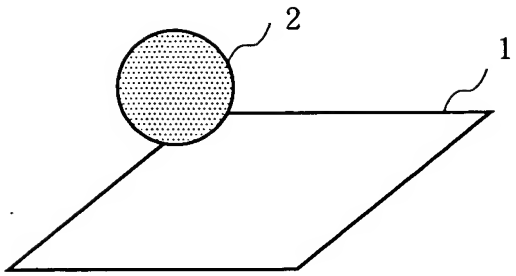
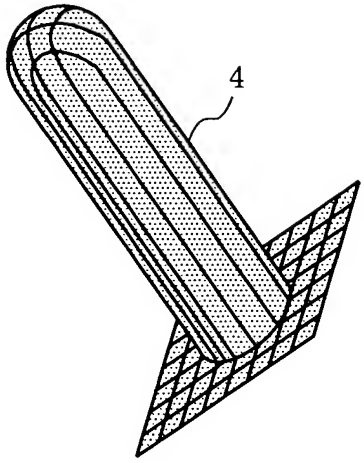


FIG. 13B



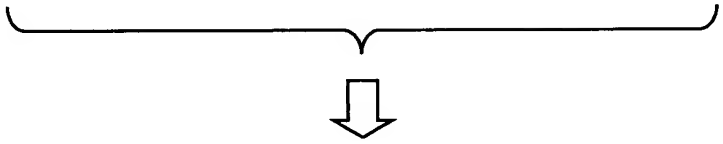


FIG. 13C

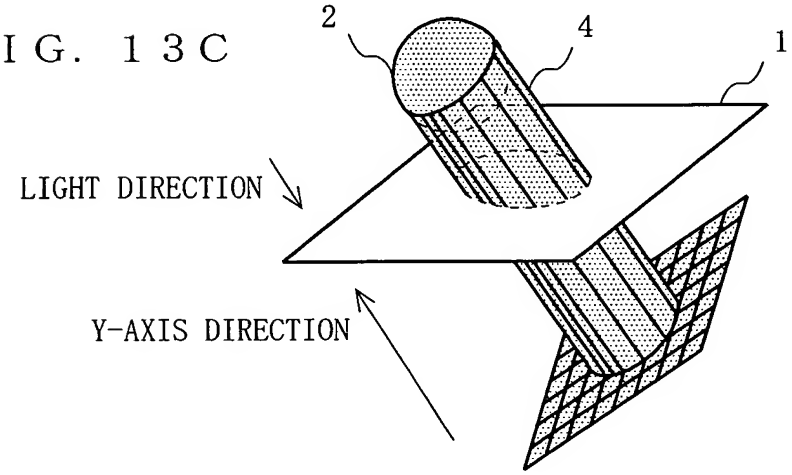


FIG. 13D

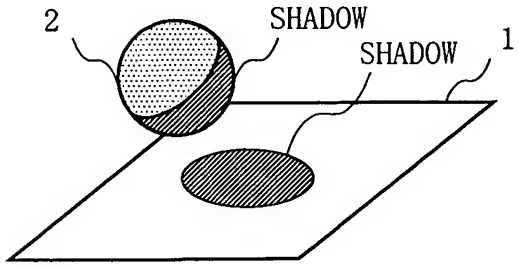


FIG. 14A

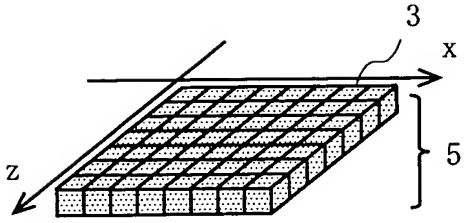


FIG. 14B

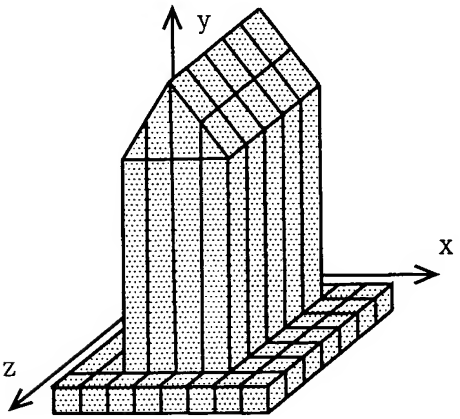
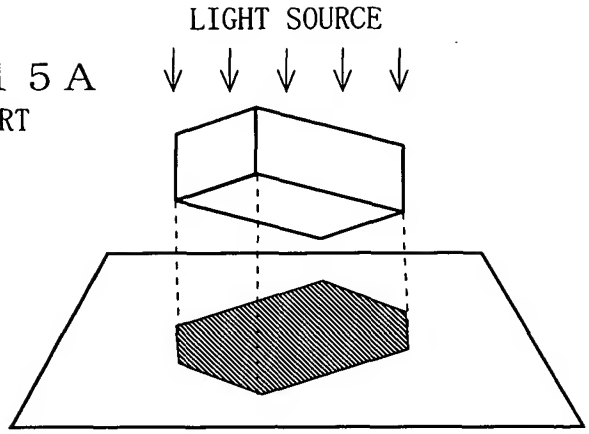
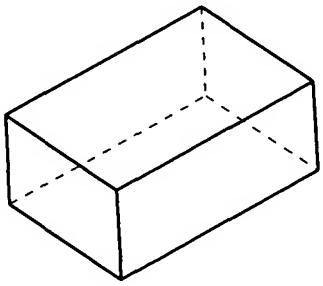


FIG. 15A
PRIOR ART



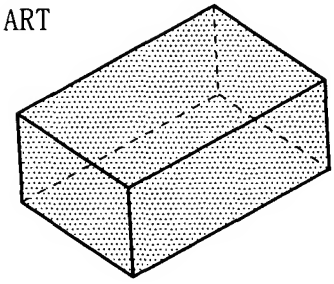
POSITIONAL RELATIONSHIP BETWEEN
LIGHT SOURCE AND SHADOW OBJECT

FIG. 15B
PRIOR ART



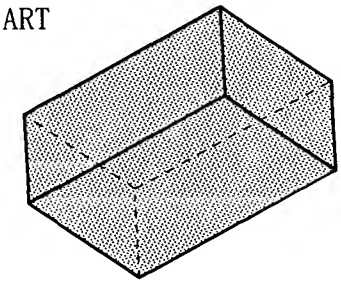
SHADOW OBJECT SEEN FROM LIGHT SOURCE

FIG. 15C
PRIOR ART



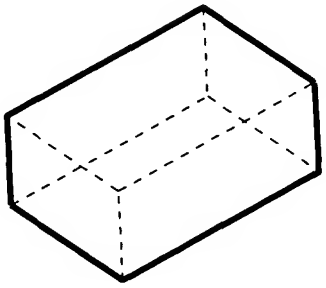
FRONT-FACING POLYGONS WITH
RESPECT TO LIGHT SOURCE

FIG. 15D
PRIOR ART



BACK-FACING POLYGONS WITH
RESPECT TO LIGHT SOURCE

FIG. 15E
PRIOR ART



EDGES SHARED BETWEEN FRONT-FACING
POLYGONS AND BACK-FACING POLYGONS

FIG. 16A
PRIOR ART

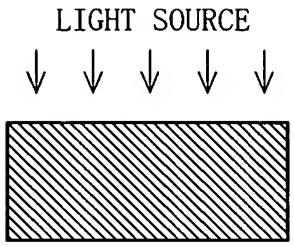


FIG. 16B
PRIOR ART

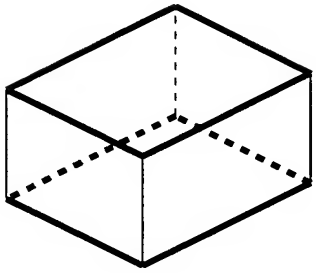


FIG. 16C
PRIOR ART

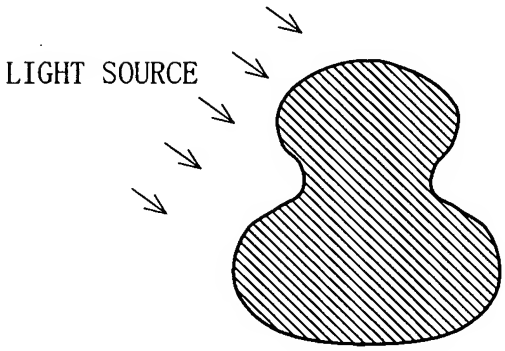


FIG. 16D
PRIOR ART

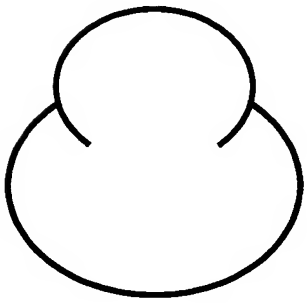


FIG. 16E
PRIOR ART

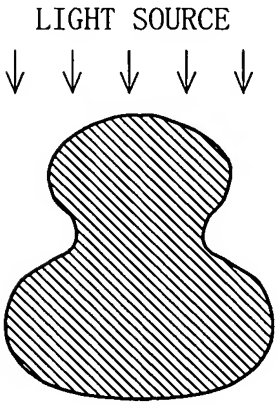
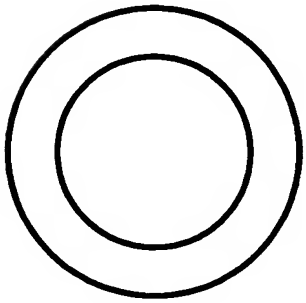



FIG. 16F
PRIOR ART